MODULAR PLUMBING SYSTEM

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FIELD OF INVENTION

The present disclosure relates generally to plumbing assemblies for connecting plumbing fixtures to the main plumbing system of a building, and specifically, to prefabricated, modular plumbing assemblies for such use.

BACKGROUND

Over the past several decades, the components comprising plumbing assemblies and the methods of installing the assemblies have become standardized. In terms of the methods of installation, the steps in the process depend in part on the structure of the building itself. Buildings are generally constructed with either of two types of foundations, concrete slab foundations or off-grade floor systems. When a concrete slab foundation is used, it is necessary to install the pipes comprising the main plumbing system of a building (the main water supply pipes and main drain pipes) and certain components of the plumbing assemblies before the concrete slab is placed. Therefore, these components must be placed in the correct orientation so the completed plumbing assemblies will be contained within the finished wall of the building so that the plumbing assemblies will not interfere with further construction of the building. Once the main water supply and drain pipes and the initial components of the plumbing assembly have been installed and pressure tested, the concrete slab is placed and construction of the building can continue. Once the building frame is constructed, typically using wooden frame members, the remainder of the plumbing assembly can then be completed and the finished walls of the building can be installed. This two step construction process is required because the complete plumbing assembly cannot be installed without the support

provided by the building frame. Installation of the plumbing assemblies in off-grade floor systems can occur in one step, since the installation occurs after the building frame has been constructed.

The components used in the plumbing assemblies, although standard, require a skilled craftsman to install. For example, the components needed for a typical bathroom lavatory installation consists of two water supply pipes (one hot and one cold) connected to the main hot and cold water supply lines, a drain pipe connected to the main drain pipe, two air chambers connected to the water supply pipes and two fixture extensions that extend from the water supply pipes through the finished walls to supply water to the lavatory. In almost all cases, it is necessary to cut each of these components to the proper size and join these components together on site to produce the finished plumbing assembly. The connection of one air chamber to one water supply pipe requires that the supply pipe be cut to the proper height, a tee joint sweated onto the supply pipe to receive the air chamber, and the air chamber sweated onto the tee joint. This process must be repeated for the second water supply pipe and air chamber. In addition, the rest of the assembly must be completed, requiring even more joints and cuts to be made. Such a process involves a high level of skill on the part of the craftsman and requires substantial amounts of time to complete. A typical bathroom lavatory installation requires 10 to 12 sweat joints, 4 to 5 glue joints and 6 to 8 cuts.

In addition to the multiple component parts required for the finished plumbing assemblies, the plumbing assemblies are generally installed within the interior space of the walls of a building. Since the plumbing assemblies are contained substantially within the wall, these components must be installed before the wall is finished. In the case of installation where a concrete slab foundation is used, the plumber must install the initial components of the plumbing assembly before even the building frame of the structure is in place. In this situation, great care must be taken so that the initial components of the plumbing assemblies are in the correct orientation so that they

will be completely enclosed within the finished wall. If the initial plumbing assemblies are not in the correct orientation, subsequent modification may be required to ensure the completed assemblies fit inside the wall as desired, adding additional time and cost to the construction process. Further complicating the issue the plumbing assemblies must be at the appropriate finished height for connection to the particular plumbing fixture.

The multiple component parts and methods of installation that are currently used make the installation process labor intensive and time consuming. In addition, since skilled craftsmen must be employed to produced the finished installation, the installation process is expensive. Finally, the installation process necessitates excessive waste and material cost, since a significant portion of material is lost as a result of cutting the components to size to produce a plumbing assembly of the correct dimensions.

Therefore, there is a need in the plumbing field for modular, prefabricated plumbing assemblies that are both economical and efficient to install so that the installation process can be accomplished in less time, at less cost with less waste.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially exploded frontal elevation view illustrating one embodiment of a modular plumbing assembly for a lavatory, laundry tub/sink or kitchen sink;

FIG. 2 is a side elevation view illustrating the fixture extensions and drain extension of the embodiment shown in FIG. 1;

FIG. 3A is a top elevation view illustrating one embodiment of the bracket used in the modular plumbing assemblies;

FIG. 3B is a side elevation view illustrating one embodiment of the bracket used in the modular plumbing assemblies;

FIG. 4 is a partially exploded frontal elevation view illustrating one embodiment of a modular plumbing assembly for a water heater;

FIG. 5A is a frontal elevation view illustrating the upper ends of the plumbing assembly shown in FIG. 4;

FIG. 5B is a side elevation view illustrating the upper ends of the plumbing assembly shown in FIG. 4;

FIG. 6A is a side elevation view of one embodiment of the optional tertiary assembly;

FIG. 6B is a frontal elevation view of one embodiment of the optional tertiary assembly;

FIG. 7 is a partially exploded frontal elevation view illustrating one embodiment of a modular plumbing assembly for a washing machine;

FIG. 8 is a frontal elevation view illustrating one embodiment of a modular plumbing assembly for a water closet;

FIG. 9 is a is a side elevation view illustrating one embodiment of a modular plumbing assembly for a water closet;

FIG. 10 is a side elevation view illustrating one embodiment of a modular plumbing assembly for a hose bibb;

FIG. 11 is a frontal elevation view illustrating one embodiment of a modular plumbing assembly for a hose bibb;

FIG. 12 is a partially exploded frontal elevation view illustrating a modular plumbing assembly for a bath or shower or bath/shower combination;

FIG. 13A illustrates the components of the optional shower assembly for the assembly shown in FIG. 12; and

FIG. 13B illustrates the components of the optional fill spout assembly for the assembly shown in FIG. 12.

DETAILED DESCRIPTION

Definitions

The following terms should be given the following meanings in this specification, the drawings and the claims that follow:

plumbing assemblies shall mean all components required for connecting a plumbing fixture to the main plumbing system of a building, but shall not include the components of the finishing kit;

plumbing fixture shall include, but not be limited to, a commode, a sink, a laundry sink, a lavatory, a washing machine, a water closet, a hose bibb, a bath, a shower and a bath/shower combination;

building shall mean any structure whatsoever, without limitation;

glue joint shall mean the joint formed between two sections of pipe (generally manufactured from PVC or similar material) which have been cut to their proper length and cleaned that is created by applying an epoxy, glue or resin to the two sections so that a seal is formed between the two sections of pipe;

sweat joint shall mean the joint formed between two sections of pipe (generally manufactured from copper) which have been cut to their proper length and cleaned that is created by applying flux to the two pipe sections, heating the two sections of pipe and applying a solder to the two sections such that a seal is formed between the two pipe sections;

finished height shall mean the height of an installed plumbing assembly, such that the plumbing assembly is at an appropriate height for connection to a particular plumbing fixture;

finishing kit shall mean all components necessary to connect the plumbing assembly to the plumbing fixture to produce a finished installation, including, but not limited to, stops, trim pieces, supplies, traps and adapters; and

rough in dimensions shall mean the initial estimation of the measurements required to ensure the plumbing assembly is at a finished height and orientation to receive a plumbing fixture.

The present disclosure describes prefabricated, modular plumbing assemblies which are suitable for installation in a building. The plumbing assemblies of the present disclosure are prefabricated and modular, incorporating all the measurements and components required for a successful installation. The instant disclosure describes several modular plumbing assemblies for the following applications: 1) installation of sink, laundry sink or lavatory; 2) installation of water heater; 3) installation of washing machine; 4) installation of water closet; 5) installation of hose bibb; and 6) installation of bath, shower or bath/shower combination.

General Principles Applicable to All Plumbing Assemblies

Although the present disclosure describes several modular plumbing assemblies for specific applications, each of the modular assemblies rely on the same design and construction principles. Current plumbing installation methods require that multiple component pieces be cut, assembled and installed on the building site. This requires that: a) the plumbing assembly be assembled and installed with rough in dimensions on site so that the finished plumbing assembly is at the appropriate finished height and orientation; b) the pipes be cut on site, which produces wasted materials; c) the pipes be joined together on site; and (d) the proper component parts gathered

together and brought to the site to avoid delays in installation. The design and construction principles of the modular plumbing assemblies of the present disclosure allow plumbing assemblies to be installed efficiently, cheaply and accurately. The plumbing assemblies are designed so that, in most cases, only 1 measurement must be made by the installer on site in order to ensure that the plumbing assembly is at the appropriate finished height for connection to a plumbing assembly. This greatly reduces the time required for installation and the accuracy of the finished installation. In addition, since the assemblies are modular and prefabricated, the problems of costly and time-consuming on site assembly and wasted material are avoided since there are fewer cuts to make and fewer joints to assemble. Additional features include mounting brackets and assembly instructions. The mounting brackets (described in more detail below) are designed to secure the pipes comprising the modular plumbing assembly to the building frame of the structure quickly and securely. The brackets, therefore, allow the components of the plumbing assemblies to be installed in the correct relationship to one another and at the appropriate finished height and orientation for connection to the plumbing fixture. The installation instructions allow the installer to quickly and accurately prepare the main plumbing system of a building to receive the modular plumbing assemblies and to install the modular plumbing assemblies of the present disclosure, so that the plumbing assemblies are in the appropriate orientation and finished height for a given installation.

Use of the modular plumbing assemblies of the present disclosure greatly simplifies the installation process, decreases the labor cost and installation time, saves on material costs and material waste and reduces the installation errors inherent in the current methods for installing plumbing assemblies. For example, while a typical bathroom lavatory installation requires 10 to 12 sweat joints, 4 to 5 glue joints and 6 to 8 cuts, using the modular plumbing assembly of the present disclosure to install a bathroom lavatory reduces the number of sweat joints to 4, the number of glue

joints to 2 and the number of cuts to 4. In addition, the modular plumbing assembly places the plumbing in the appropriate orientation and at the correct finished height to receive the lavatory fixture, thereby eliminating almost all installation errors.

The modular plumbing assemblies can be sold as complete units in kit form, or can be sold as individual pieces. Each kit would contain the appropriate modular plumbing assembly for installation to a specific plumbing fixture and installation instructions sufficient to permit one of ordinary skill in the art in the plumbing field to complete the installation. Optionally, the kits may also include a finishing kit that includes all the trim pieces, stops, adapters and supplies needed for a particular installation. The finishing kit provides the advantage that all the components for a professionally finished installation are present and that these components are matched to fit the diameter pipes used in a particular installation. This eliminates the need to purchase the components separately and ensures a pleasing finished look to the installation. The content of the finishing kit will vary depending on the particular plumbing assembly to be installed. In addition, the plumbing assemblies may be supplied as one unit, or each assembly may be broken down into smaller assemblies. In general it will be necessary to provide smaller assemblies when installation of the plumbing assemblies occurs on a concrete slab foundation.

In the descriptions that follow, the modular plumbing assemblies will be described as incorporating polyvinylchloride (PVC) pipe for the drain pipes and copper pipes for the water supply pipes, extensions and other water carrying pipes. It is understood within the field that PVC covers all schedules and thicknesses of PVC. However, it should be understood that any material that meets local building codes can be substituted for PVC and/or copper, and still be within the spirit of the disclosure. For example, chlorinated polyvinylchloride (CPVC), poly-butylene, butylene or stainless steel can be used in place of copper and cast iron or copper can be used in place of PVC, when local building codes permit. In addition, detailed description of pipe diameters is not given, and is not critical to the present disclosure. The proper pipe diameter for a particular application is well within the knowledge of one of ordinary skill in the art in the plumbing field, and the present

disclosure should be understood to include all relevant pipe diameters. Furthermore, when caps or sealed ends are incorporated into a modular plumbing assembly, the caps and sealed ends may be color coded with red or blue caps or markings, with the red color indicating a hot water connection and the blue color indicating a cold water connection. In addition, although the plumbing assemblies are described as being connected to the main plumbing system of a building, it is understood that the components of the main plumbing system may vary depending on the plumbing assembly installed. Finally, when two pipe ends are joined together to form joints, it is preferred that in order to facilitate joint formation, one of the pipe ends will contain a standard bell connection, and the other of the two pipe ends will be adapted to connect with the bell connection. Alternatively, if bell connections are not employed, a suitable coupling can be used to join the two pipe ends together, with the coupling being essentially a short section of pipe with two bell ends.

The following examples illustrate preferred embodiments of the modular plumbing assemblies and alterations, such as, but not limited to, the pipe materials, assembly steps, joint connections and other variables within the knowledge of one of ordinary skill in the plumbing field should be considered within the scope of the present disclosure.

Modular Plumbing Assembly for a Lavatory, Sink or Laundry Sink

A modular plumbing assembly, **10**, for a lavatory, sink or laundry sink is described below and shown in FIGS. 1 and 2. FIG. 1 illustrates an embodiment of the assembly **10** for installation on a concrete slab foundation where the assembly **10** is composed of a primary assembly **12** and a secondary assembly **14**. It should be considered within the scope of the disclosure to provide assembly **10**, and the other assemblies described hereafter, as a single unit, further eliminating the time and manpower required to install the assemblies.

In its most basic form, assembly **10** comprises 2 water supply pipes and a drain pipe. Throughout the remainder of the specification and the claims that follow the water supply pipes may be designated as hot and cold, or simply referred to without a designation of hot and cold it being

understood that one water supply pipe will supply hot water and the other water supply pipe will supply cold water. The assembly **10** comprises a primary assembly **12** and a secondary assembly **14**. The primary assembly **12** further comprises a bracket **70**, hot and cold water supply pipes **20A** and **20B** and a drain pipe **28**. The hot and cold water supply pipes **20A** and **20B** each have an upper end **22A** and **22B** and a lower ends **24A** and **24B**. Supply pipes **20A** and **20B** may be covered by color coded caps **25A** (red) and **25B** (blue) to prevent debris from entering the pipe during installation and to identify the pipes quickly during installation. Supply pipes **20A** and **20B** each have bell connectors **26A** and **26B** on lower end **24A** and **24B**. The drain pipe **28** has a sealed upper end **30** and a lower end **32**, with a bell connector **34** on lower end **32**, and at least one cut line **31** on sealed upper end **30**. The sealed upper end **30** functions to provide a seal so that the drain pipe assembly can be pressure tested before further installation continues.

The secondary assembly **14** further comprises hot and cold water supply extensions **50A** and **50B**, sealed fixture extensions **58A** (red end) and **58B** (blue end), a drain pipe extension **60**, a drain connection **68** and a mounting bracket **70**. The water supply extensions **50A** and **50B** each have upper ends **52A** and **52B** and lower ends **54A** and **54B**, with bell connection **55A** and **55B** on lower ends **54A** and **54B** and air chambers **56A** and **56B** on upper ends **52A** and **52B**. The fixture extensions **58A** and **58B** have at least one cut line **59A** and **59B** on the sealed ends and extend laterally from the hot and cold water supply extensions **50A** and **50B** at predetermined locations so that they will be at the appropriate height for connection to the plumbing fixture. The drain pipe extension **60** has an upper end **62** and a lower end **64**, with bell connections **66A** and **66B** on upper end **62** and lower end **64**, respectively. A sealed drain connection **68** is located on drain extension **60** and extends laterally from the drain pipe extension **60**. The lengths of the fixture extensions **58A** and **58B** and the drain connection **68** are such that they extend laterally a sufficient distance to extend beyond the finished wall for connection to the plumbing fixture. FIG. 2 further illustrates the configuration of the fixture extension **58A** and the drain connection **68**. (fixture extension **58B** is obscured by fixture extension **58A**). The diameter of the drain connection **68** is selected so that it

is the proper diameter for the particular plumbing fixture being installed. For instance, if a bathroom lavatory is being installed, the drain connection **68** will have a diameter of approximately 1-1/4 inches. If a laundry tub/sink is being installed, the drain connection **68** will have a diameter of approximately 2 inches. The incorporation of the proper size drain connection **68** eliminates the need to reduce or enlarge the diameter of the drain connection with bulky adapters. The result is a finished installation that is sure to be enclosed withing the finished wall and that is aesthetically pleasing to the eye since openings in the finished wall are correct diameter and the trim pieces will fully cover the openings in the finished wall. The components of the primary assembly **12** and the secondary assembly **14** are secured in brackets **70** to building frame members 16.

The bracket **70** (shown in FIGS. 3A and 3B) may be constructed from any type of material that will provide a rigid structure, such as stamped galvanized iron. The dimensions of the bracket **70** can be varied, but in a preferred embodiment the bracket **70** is 3 ½ inches wide and 14 ½ inches in length in order to conform to the width and the spacing of the frame members **16** in a typical building. The bracket **70** comprises a base **72** having two outer sides **74A** and **74B** and right and left ends **76A** and **76B**, respectively. Downwardly turning legs **78A** and **78B** extends from each of the ends **76A** and **76B**, forming generally a 90 angle with the base **72**. Gang nails **80A** and **80B** are incorporated into the legs **78A** and **78B** to secure bracket **70** to frame members **16**. Other means to secure the bracket **70** to the frame members **16** include, but are not limited to nails, screws or bolts. Fins **82A** and **82B** may optionally be attached to each leg **78A** and **78B** to receive the frame members **16**. In a preferred embodiment, the fins **82A** and **82B** extend at a 90 angle from each leg **78A** and **78B**, forming a channel **84** to receive the frame member **16**. The base **72** contains a plurality of openings **86** to receive the components of assembly **10**. The openings **86** are generally circular, with a diameter adapted to securely receive the components of the plumbing assembly. The openings **86** may optionally contain sleeves **88**. The configuration of openings **86** on base **72** will vary depending on the particular installation and alterations in the configuration should be considered within the scope of the present disclosure. In the embodiment shown in FIG. 3B, bracket

70 is adapted to receive the components of the primary assembly **12** and one opening **86** is centered on base **72** and two openings **86** are offset from the center of base **72** by 4 and 8 inches to correspond to standard installations.

The installation of assembly **10** will vary depending on the circumstances of the installation as stated in the installation instructions provided with assembly **10**, but will follow the principles described below, with differences from these general principles being apparent to one of ordinary skill in the art in the plumbing field. As described above, for concrete slab foundations it is necessary to install the modular plumbing assembly **10** in two steps. The first step is the joining of the primary assembly **12** to the main drain pipe **90**. The height of drain pipe **90** from the finished floor will vary depending on the plumbing fixture to be installed, with the proper height being given in the installation instructions. Main drain pipe **90** is cut so that it extends the appropriate height from the finished floor. This is the only measurement required in the installation of assembly **10**. The remainder of the measurements are predetermined through the structure of the primary assembly **12** and the secondary assembly **14** and use of bracket **70,** so that the completed plumbing assembly **10** will be at the appropriate finished height and orientation for the plumbing fixture to be installed. Once the main drain pipe **90** is cut to the proper height, the primary assembly **12** is secured to the main drain pipe **90** via a glue joint between the bell connection **34** on the lower end **32** of drain pipe **28** and the main drain pipe **90**. Once the drain pipe **28** is connected to the main drain pipe **90**, the main water supply lines **92A** and **92B** may be connected to hot and cold water supply pipes **20A** and **20B** via a sweat joint between bell connection **26A** and **26B** on lower ends **24A** and **24B** and the main water supply lines **92A** and **92B**. The primary assembly **12** is secured to the frame members **16** by the gang nails **80A** and **80B** on bracket **70**.

Next, the secondary assembly **14** is secured to the primary assembly **12**. Since the primary assembly **12** and the secondary assembly **14** are a constant length for all plumbing assemblies **10**, the length of the main drain pipe **90** will determine the finished height of the modular plumbing assembly **10**. The drain pipe **28** is cut along cut line **31** for attachment to the drain

extension **60**. Although the order of connection can be varied, it is generally more efficient to connect the drain pipe extension **60** to the drain pipe **28** via a glue joint between the bell connection **68** of drain extension **60** and the upper end **30** of drain pipe **28**. The water supply extensions **50A** and **50B** are then connected to the water supply pipes **20A** and **20B** via a sweat joint between bell connections **55A** and **55B** on water supply extensions **50A** and **50B** and the upper ends **22A** and **22B** on hot and cold water supply lines **20A** and **20B**. The water supply extensions **50A** and **50B** can be moved up and down relative to bracket **70** if needed in joining the water supply extensions **50A** and **50B** to the water supply pipes **20A** and **20B**. The bracket **70** is then secured to the frame members **16** via gang nails **80A** and **80B**. At this point installation of the modular plumbing assembly **10** is complete, and the finished walls of the structure can be installed to cover the modular plumbing assembly **10**, with only extensions **58A** and **58B** and drain connection **68** extending through the finished wall. The finished modular plumbing assembly **10** is at the appropriate finished height and orientation for connection to the selected plumbing fixture. A shown in FIG. 2, the extensions **58A** and **58B** are sealed for pressure testing, and it is necessary to cut the ends of extensions **58A** and **58B** along the pre-marked cut lines **59A** and **59B** before hook-up to the specific plumbing fixture. The sealed end of drain connection **68** must also be cut before hook up to the plumbing fixture. The optional finishing kit contains the stops, supplies, traps and adapters required for connection of the extensions **58A** and **58B** and drain connection **68** to the plumbing fixture. If installation of assembly **10** occurs after the frame members **16** are installed, as in a building with an off-grade floor system, primary assembly **12** and secondary assembly **14** may be supplied as one unit and secured to frame members **16**, with installation to the main drain pipe **90** and the main water supply lines **92A** and **92B** being essentially as described above.

Modular Plumbing System for Water Heater Installation

A modular water heater plumbing assembly, **100**, is described below and shown in FIGS. 4-6. FIG. 4 illustrates an embodiment of assembly **100** which is composed of a primary

assembly **102**, a secondary assembly **104** and optionally, a tertiary assembly **106** (shown in FIG. 6). It should be considered within the scope of the disclosure to supply all of these assemblies, or a combination thereof, as one unit. The primary assembly **102** further comprises hot and cold water supply pipes **108A** and **108B**, respectively, a relief pipe **116** and a bracket **70**. The bracket **70** is essentially the same as previously described except that openings **86** may be of different diameter and configuration in order to securely receive the components of assembly **100**. The hot and cold water supply pipes **108A** and **108B** each comprise lower ends **110A** and **110B**, upper ends **112A** and **112B** and bell connections **114A** and **114B** on lower ends **110A** and **110B**. The relief pipe **116** comprises a lower end **118**, an upper end **120** and a bell connection **122** on lower end **118**. In addition, color coded caps **115A** (red), **115B** (blue) and **115C** (green) are supplied for the hot and cold water supply pipes **108A** and **108B** and the relief pipe **116**, respectively, to keep debris from entering the pipes during installation and to quickly identify the pipe during installation.

As illustrated in FIGS. 4, 5A and 5B, the secondary assembly **104** further comprises sealed hot and cold water supply extensions **124A** and **124B**, a sealed relief pipe extension **134** and a bracket **70**. The sealed ends **128A** and **128B** of the hot and cold water supply extensions **124A** and **124B** may be marked with a cut line **129A** and **129B** and coded with a red and blue color respectively. Likewise, the sealed end **138** of relief pipe extension **134** may be marked with a cut line **139** and coded with a green color. The hot and cold water supply extensions **124A** and **124B** have lower ends **126A** and **126B**, upper ends **128A** and **128B**, with bell connections **130A** and **130B** on lower ends **126A** and **126B** and air chambers **149A** and **149B**. The relief pipe extension **134** has a lower end **136**, an upper end **138** and a bell connection **140** on lower end **136**. The components of the primary assembly **102** and the secondary assembly **104** are secured in brackets **70**. The upper ends **128A**, **128B** and **138** extend laterally from the plane defined by the lower ends **126A**, **126B** and **136** and are a sufficient length to extend through the finished wall to allow connection to the water heater.

As illustrated in FIG. 6A and 6B, the tertiary assembly **106** comprises hot water connection **142**, a relief connection **144** and a cold water connection **146**. The hot water connection **142**, relief connection **144** and cold water connection **146** are provided as pre-assembled units. The hot water connection **142** has a first end **170**, a second end **172**, a bell connection **174** on the first end **170** and a dielectric union **160** on its second end **172**. The relief connection **144** has a first end **180**, a second end **182**, a bell connection **184** on the first end **180** and a dielectric union **160** on its second end **182**. The cold water connection **146** has a first end **150** and a second end **152**, with a bell connection **154** on the first end **150**, a valve **156** integral with cold water connection **146** and a dielectric union **160** on its second end **152**. In a preferred embodiment, valve **156** is a gate valve, but other types of valves that allow for maximum water flow could also be used. The cold water connection **146** and hot water connection **142** are connected to water heater **194** through dielectric unions **160**.

In contrast to the installation of modular plumbing assembly **10**, modular water heater plumbing assembly **100** is generally installed after the building has been roughed in with frame members **16**. Therefore, the assembly **100** may be installed as a single unit in both concrete slab and off-grade floor system constructions, or can be installed in smaller assemblies as described below. The final installation height of water heaters varies depending on the make and capacity of the water heater. The installer consults the installation instructions provided with the assembly **100** and determines the make and capacity of the water heater to be installed. The installation instructions provide the installer with the proper height for the installation of mounting bracket **70** containing the primary assembly **102**. This is the only measurement required in the installation process for assembly **100**. Since the length of the remainder of assembly **100** and its components is constant, the height of mounting bracket **70** determines the finished height of assembly **100**.

Once the mounting bracket **70** is installed, the hot and cold water supply pipes **108A** and **108B** are connected to main hot and cold water supply pipes **190A** and **190B**, respectively, via sweat joints between bell connections **114A** and **114B** of hot and cold water supply pipe **108A** and

108B and the main hot and cold water supply pipes **190A** and **190B**. The relief pipe **116** is connected to the main relief pipe **192** via a sweat joint between bell connection **122** on lower end **118** of relief pipe **116** and the main relief pipe **192**. The primary assembly **102** is then ready to receive the secondary assembly **104**.

The hot and cold water supply extensions **124A** and **124B** are connected to hot and cold water supply pipes **108A** and **108B** via sweat joints between the bell connections **130A** and **130B** of hot and cold water extensions **124A** and **124B** and the upper ends **112A** and **112B** of hot and cold water extensions **108A** and **108B**, respectively. The relief pipe extension **134** is connected to relief pipe **116** via a sweat join between bell connection **140** on lower end **136** of relief pipe extension **134** and the upper end **120** of relief pipe **116**. The secondary assembly is then secured to frame members **16** via gang nails **80A** and **80B** on bracket **70**, or other means as described above. Once the secondary assembly **104** is connected, the partially completed assembly is at the appropriate finished height for connection to the particular water heater selected for installation. At this point the finished walls of the building can be installed to cover the modular plumbing assembly **100**, with only the upper ends **128A**, **128B** and **138** extending through the finished wall. The upper ends **128A**, **128B** and **138** are cut along the cut lines **129A**, **129B** and **139**, respectively. The modular plumbing assembly **100** is now ready to receive tertiary assembly **106**, if used. Since the modular water heater assembly **100** is installed after the structure has been roughed in with frame members **16**, primary assembly **102** and secondary assembly **104** could be combined into one assembly if desired, and installed in one step.

The optional tertiary assembly **106** connects the assembly **100** to the water heater **194**. The tertiary assembly **106** is designed to accommodate a finished wall dimension of ½ to 1 inch and allow for a clearance of 1 ½ to 2 inches from the finished wall. The hot water connection **142** is connected to the hot water extension **124A** via sweat joint between bell connection **174** on first end **170** and the upper end **128A** of hot water supply extension **124A**. The relief connection **144** is connected to the relief pipe extension **134** via a sweat joint between the bell connection **184** on first

end **180** and the upper end **138** of relief pipe extension **134**. The cold water connection **146** is connected to the cold water supply extension **124B** via a sweat joint between bell connection **154** on first end **150** and the upper end **128B** of cold water supply extension **124B**. The hot water connection **142**, the relief pipe connection **144** and the cold water connection **146** are connected to the water heater **194** via male threaded connections on dielectric unions **160** and female threaded connections (not shown) on water heater **194** according to the water heater manufacturer's instructions and local building regulations. In the event the water heater **194** is not provided with female threaded connections, commercially available threaded adapters can be used to supply the appropriate threaded connection.

Because no sweat joints are required to connect the hot water connection **142**, the relief pipe connection **144** and the cold water connection **146** to water heater **194**, no heat is applied to the top of the water heater **194**. A common result of applying heat to the top of the water heater **194** is damage to the components of the water heater, especially the cold water carrying pipe (not shown), which is often constructed of plastic. In addition, the threaded connection allows the water heater to be easily disconnected and replaced if required without extensive modification to the plumbing system.

Optionally, a finishing kit that contains the trim pieces, adapters and other components needed for a finished installation may be supplied with assembly **100**. In the case of assembly **100**, the finishing kit would include Teflon tape to be used in conjunction with the mechanical threaded connections.

Modular Plumbing System for Washing Machine Installation

A modular washing machine plumbing assembly, **200**, is described below and shown in FIG 7. FIG. 7 illustrates an embodiment of assembly **200** comprising the primary assembly **202** and the secondary assembly **204**. It should be considered within the scope of the disclosure to supply these assemblies as one unit. The primary assembly **202** further comprises hot and cold water supply lines, **208A** and **208B**, drain pipe **220** and bracket **70**. The hot and cold water supply lines, **208A** and

208B have lower ends **210A** and **210B**, sealed upper ends **212A** (red) and **212B** (blue) and bell connections **214A** and **214B** on the lower ends **210A** and **210B**. The upper ends **212A** and **212B** of hot and cold water supply lines **208A** and **208B** are pre-marked with cut-lines **218A** and **218B**. The drain pipe **220** has a lower end **222**, a sealed upper end **224** and a bell connection **226** on the lower end **222**. The sealed upper end **224** is pre-marked with cut-line **228**. The hot and cold water supply lines, **208A** and **208B** and drain pipe **220** are secured in bracket **70**.

The secondary assembly **204** comprises hot and cold water extensions **230A** and **230B**, drain assembly **242** and bracket **70**. The hot and cold water extensions **230A** and **230B** have lower ends **232A** and **232B** and bell connections **236A** and **236B** on the lower ends **232A** and **232B**. The hot and cold water extensions **230A** and **230B** further comprise valves **240A** and **240B** at the upper ends **234A** and **234B** and flexible connectors **238A** and **238B**, extending from above bell connections **236A** and **236B** and extending at least partially along the length of hot and cold water extensions **230A** and **230B**. The exact length of the flexible connectors **238A** and **238B** is not critical, as long as they provide the flexibility to allow connection of the hot and cold water extensions **230A** and **230B** to the hot and cold water supply lines **208A** and **208B**. The particular embodiment of the valves is not critical to the present disclosure. However in the embodiment shown in FIG. 7, a ball valve is shown. The drain assembly **242** comprises a vent stack **244**, a trap **252** and connecting section **254**. The trap **252** is contiguous with and branches from lower end of the vent stack **244** on one end, and is contiguous with the lower end of the connecting section **254** on the other end. Bell connectors **250A** and **250B** are present on the upper and lower ends of the vent stack **244**. The connecting section **254** has an upper end **258**. The exact configuration of drain assembly **242** is not critical to the present disclosure, with the embodiment illustrated serving only as a guide. The exact configuration of the secondary assembly **204** can vary, as long as each of the elements is incorporated therein. The hot and cold water extensions **212A** and **212B** and the drain assembly **242** are secured in bracket **70**.

The bracket **70** is as described above and shown in FIG. 3, with the exception that the openings **86** of bracket **70** have different diameters and the configuration of the openings **86** are adapted to secure the components of the primary assembly **202** and the secondary assembly **204**.

A connection box **206**, may be incorporated into assembly **200** to further secure the components of assembly **200** and provide electrical connections for the washing machine (not shown). The connection box **206** is designed to receive the assembly **200** in an attractive and functional manner, and is be secured to the frame members **16** by any conventional means, such as screws or nails. The connection box **206** comprises a face plate **260**, an interior space **262**, an electrical receptacle **272** and a junction box **274**. The interior space **262** is defined by a lower and upper interior wall **264** and **266**, respectively, and a right and left interior wall, **268** and **270**, respectively. The dimensions of the interior space **262** are sufficient to receive the connecting section **254** and the hot and cold water extensions **230A** and **230B**. The face plate **260** contains a section to receive an electrical receptacle **272**. A cavity **278** in connection box **206** is defined by the face plate **260**, the left interior wall **268** and a frame member **16**. The cavity **278** receives the vent stack **244**. The electrical receptacle **270** is pre-wired (according to standard electrical practices) for a 110 volt connection with the wiring terminating in a junction box **274**. The wiring is optionally encapsulated in a non-conductive material or foam. The electrical receptacle **270** may be slightly raised above the surface of the face plate section **260** to provide the necessary clearance for vent stack **244**.

The installation of assembly **200** is guided by installation instructions provided with assembly **200**. The main drain pipe **290** is cut so that it extends 8 inches from the finished floor and the main hot and cold water supply pipes **292A** and **292B** are cut to extend 4 inches from the finished floor. The drain pipe **220** is connected to the main drain pipe **290** via a glue joint between the bell connection **226** of drain pipe **220** and main drain pipe **290**. When the glue joint is set, the hot and cold water supply lines **208A** and **208B** are connected to the main hot and cold water supply lines **292A** and **292B** via a sweat joint between bell connections **214A** and **214B** on the hot and cold water

supply lines **208A** and **208B** and the main hot and cold water supply lines **292A** and **292B**. The bracket **70** is secured to the frame members **16** by gang nails **80A** and **80B**. Once pressure testing is complete, drain pipe **220** is cut along cut line **228**, and hot and cold supply lines **208A** and **208B** are cut along cut-lines **218A** and **218B**. The primary assembly **202** is now ready to receive the secondary assembly **204**.

The drain assembly **242** is connected to the drain pipe **220** via a glue joint between the bell connection **250B** on vent stack **244** and the upper end **224** of drain pipe **220**. Once the glue joint is set, hot and cold water extensions **230A** and **230B** are connected to the hot and cold water supply pipes **208A** and **208B** via a sweat joint between bell connections **236A** and **236B** on hot and cold water extensions **230A** and **230B** and the upper ends **212A** and **212B** of hot and cold water supply pipes **208A** and **208B**. Flexible extensions **236A** and **236B** aid in this connection process. The bracket **70** is secured to the frame members **16** by gang nails **80A** and **80B**. The upper end **258** of the connecting section **254** terminates in connecting box **206**. The upper ends **234A** and **234B** of hot and cold water extensions **230A** and **230B** extend above the lower interior wall **264** and extend into the interior space **262** of connecting box **206**. The vent stack **244** extends behind face plate **260** through cavity **272**. The vents stack **244** will be connected to additional vent pipes (not shown).

Modular Plumbing System for Water Closet Installation

A modular water closet plumbing assembly, **300**, is described below and shown in FIGS. 8 and 9. The assembly **300** comprises supply line **302**, the supply line **302** comprising an upper end **306** and a lower end **308**, an air chamber **310** contiguous with and extending from the upper end **306** and an extension **314** located at a predetermined location on supply line **302**.

Extension **314** is pre-marked with a cut line **316**, shown in FIG. 9, and extends a sufficient distance to extend beyond the finished wall to allow for connection to the plumbing fixture. A bell connection **318** is supplied on the lower end **308** of supply line **302** for attachment to main supply line **350**. A connecting means, shown in FIG. 9 as tang **320**, is connected to upper end **312** of air chamber **310** to secure assembly **300** to mounting bracket **330**. Assembly **300** may be secured to frame members **16** by other bracket configurations, so long as assembly **300** is secured in its proper orientation. The tang **320** is a L-shaped bracket extending from the upper end of air chamber **310** at a roughly 90 degree angle.

Mounting bracket **330** can be constructed of any material capable of providing a rigid structure for attachment of assembly **300**, preferably stamped galvanized iron. Bracket **330** comprises a center section **332**, and a left leg **334** and a right leg **336**, the left and right legs **334** and **336** extending from opposite ends of center section **332** at roughly a 90 degree angle. Center section **332** contains openings **338** along its entire length to receive tang **320** or other securing means. Bracket **330** is secured to frame members **16** by gang nails **340** on the left and right legs **334** and **336**, respectively. Other means to secure bracket **330** to the frame members **16** include, but are not limited to, nails, screws and bolts.

The installation of assembly **300** is guided by the installation instructions provided with assembly **300.** Supply pipe **350** is cut so that the top of supply pipe **350** extends 3 inches from the top of the finished floor. Supply line **302** is connected to supply pipe **350** via a sweat joint between bell connection **318** on lower end **308** and the main supply pipe **350**. Mounting bracket **330** is connected to assembly **300** by inserting the tang **320** or other securing means through openings **338**. The mounting bracket **330** is then secured to frame members **16** via gang nails **340** or other securing means. The assembly **300** is now ready for pressure testing. Before connection to the water closet (not shown), extension **314** is cut along cut line **316**. A finishing kit may be optionally supplied with assembly **300**. The kit would contain the stops, trim, supply and other components required for a finished installation.

Modular Plumbing System for Hose Bibb Installation

A modular plumbing assembly, **400**, for a hose bibb is shown in FIG. 10. Assembly **400** comprises a supply pipe **402**, an extension **418** and a sill cock assembly **426**. The supply pipe **402** comprises a lower end **404** and an upper end **406**, and a top portion **408.** The top portion **408** has a front end **410** and a back end **412**, with the front end **410** containing a female threaded cavity **414**. The back end **412** is contiguous with a mounting bracket **416**. The exact configuration of mounting bracket **416** is not critical to the present disclosure. The supply pipe **402** has a bell connection **418** on lower end **404**. Extension **418** has a male threaded end **420**, a non-threaded end **422** and wrench grips **424** near the threaded end **420** to aid in installation. Sill cock assembly **426** comprises a face plate **428**, a standard faucet assembly **430** and a connecting section **432**. Alternatively, a commercially available freeze-proof sill cock can be used in place of sill cock assembly **426**.

Installation of assembly **400** is guided by installation instructions provided with assembly **400**. The installer determines the desired finished height for assembly **400** and cuts main water pipe **450** to the proper height as instructed by the installation instructions. Supply pipe **402** is joined to main water pipe **450** via a sweat joint between bell connection **418** on lower end **404** of supply pipe **402** and main water supply pipe **450**. The assembly **400** is secured to the frame cross member **17** via mounting bracket **416**, or other suitable structure, as illustrated in FIG. 11. The male threaded end **420** of extension **418** threadably inserts into the female threaded cavity **414** of front end **410**. The length of extension **418** can be varied and will depend on the thickness of the outer wall (not shown). The connecting section **432** of the sill cock assembly **426** is adapted to join to the non-threaded end of extension **418** via a sweat joint. An isolation block **436** may be placed around connecting section **432** (or in a similar position on a freeze-proof sill cock) when stone or masonry outer walls are installed. The isolation block **436** offers protection from freezing conditions by lowering the cold transduction from the outer wall to the sill cock. The isolation block **436** can be manufactured from plastic resins or other materials that confer insulative properties. The dimensions

of isolation block **436** are such that it extends from the face plate **428** of sill cock **426** to not closer than 1 ½ inches from the finished wall. Teflon tape to be used in conjunction with the mechanical threaded connections may be supplied with assembly 400.

Modular Plumbing System for Bath/Shower Installation

A modular plumbing assembly for a bath, shower or bath/shower combination, **500**, is shown in FIG. 12. The assembly **500** comprises a primary assembly **502** and at least one water discharge assembly. The water discharge assembly may be either a fill spout assembly, a shower assembly or both the fill spout assembly and the shower assembly. The primary assembly **502** further comprises hot and cold water supply pipes, **506A** and **506B**. Assembly **500** may optionally comprise a valve assembly **536**. The hot and cold water supply pipes, **506A** and **506B** further comprise lower ends **508A** and **508B**, upper ends **510A** and **510B**, air chambers **514A** and **514B** and valve extensions **516A** and **516B** branching from supply pipes **506A** and **506B** at predetermined locations thereon. The valve extensions **516A** and **516B** have outer ends **518A** and **518B**.

The shower assembly comprises and a shower assembly connecting pipe **528** a shower assembly pipe **550,** a shower arm **552** and a shower head **554** (shown in FIG. 13A). The shower assembly pipe **550** has a lower end **556** and an upper end **558**, with a bracket **416** on one end of upper end **558**. The shower arm **552** has male threaded first and second ends **563** and **564**, respectively, adapted to connect to the shower assembly pipe **550** through the female cavity **562** and the shower head **554**. A bracket **416** secures the shower assembly pipe **550** to the frame cross member (not shown). The fill spout assembly comprises a fill spout assembly connecting pipe **520**, a fill spout assembly pipe **530**, an extension **540** and a fill spout **542** (shown in FIG. 13B). The fill spout supply pipe **530** has an upper end **532** and a lower end **534**, with a threaded female cavity **538** on its lower end **534.** The extension has male threaded first and second ends **541** and **543**, respectively, adapted to connect to the fill spout supply pipe **530** through the female cavity **538** and

to the fill spout **542**. A bracket **416** secures the fill spout assembly pipe **530** to the frame cross member (not shown).

The valve extensions **516A** and **516B**, the shower assembly connecting pipe **528** and the fill spout assembly connecting pipe **520** are each joined to the optional valve assembly **536** by dielectric unions **540A-D**. The dielectric unions **540A-D** are preferably joined to the outer ends **518A** and **518B** of valve extensions **516A** and **516B** and, to the lower end **530** of shower assembly connecting pipe **528** and to the upper end **524** of fill spout assembly connecting pipe **520**, respectively, via sweat joints, and to the valve assembly **536** by standard threaded connections.

The fill spout assembly connecting pipe **520** is joined to the fill spout assembly pipe **530** via a sweat joint between bell connection **536** on lower end of fill spout assembly connective pipe **520** and the upper end of fill spout supply pipe **530**. The extension **540** threadably inserts into the female cavity **538** on the fill spout assembly pipe **530** and the fill spout **542** via male threaded ends **541** and **543**, respectively. The shower assembly connecting pipe **528** is joined to shower supply pipe **550** via a sweat joint between bell connection **560** of shower assembly connecting pipe **528** and the lower end **556** of the shower supply pipe **550**. The shower arm **552** threadably inserts into the female cavity **562** on the shower supply pipe **550** and the shower head **554** via male threaded ends **563** and **564**. The shower assembly and fill spout assembly are secured to frame cross member **17** via brackets **516**. Bracket **516** is secured to frame cross member **17** by any convenient means, such as, but not limited to, nails, screws or bolts.

The assembly **500** may be used with a variety of valve configurations, including, but not limited to, single lever, double handle or triple handle systems. The valve assembly **536** is selected depending on the particular valve configuration chosen, with valve assembly **536** being commercially available as a unit. The valve assembly **536** is sold either singularly or in combination with assembly **500**. The assembly **500** may be used with a bath/shower combination or for either component individually. If only a shower unit is desired, the fill spout assembly connecting pipe **520** is eliminated from assembly **500** and an appropriate valve assembly **536** is selected. If only a tub

unit is desired, shower assembly connecting pipe **528** is eliminated and an appropriate valve assembly **536** is selected.

Installation of assembly **500** is guided by the installation instructions provided with assembly **500**. The hot and cold water supply pipes, **506A** and **506B**, are connected to the main hot and cold water pipes **551A** and **551B** via sweat joints between the bell connections **512A** and **512B** on the lower ends **508A** and **508B** and the main hot and cold water lines **551A** and **551B**. The length of the hot and cold water supply pipes, **506A** and **506B**, are such that the valve assembly **536** will be at a finished height suitable for most applications when the main pipes **551A** and **551B** are cut 3 inches from the finished floor. However, the placement of the valve assembly **536** will vary depending on customer preferences, and exact measurements for installation may be modified if desired based on customer preference. If it is desired to increase the finished height of the valve assembly **536**, the main pipes **551A** and **551B** can be cut so that they extend greater than 3 inches from the finished floor, or additional pipe can be added to the hot and cold water supply pipes **506A** and **506B**. If it is desired to decrease the finished height of the valve **536**, the main hot and cold water pipes **551A** and **551B** can be cut so that they extend less than 3 inches from the finished floor, or the hot and cold water supply pipes **506A** and **506B** can be decreased by removing lengths of pipe. The placement of the fill spout and shower head is also variable and depends on customer preferences. Again, the length of the fill spout assembly connecting pipe **520** and the shower assembly connecting pipe **528** is supplied to give a finished height for the fill spout and/or shower head suitable for most customers. If a different finished height is desired, the length of these pipe sections may be decreased by removing a sections of pipe, or increased by adding sections of pipe.

The above discussion has described several embodiment of the plumbing assemblies in detail so that the assemblies and their principles of operation may be understood. The above discussion should not be interpreted to exclude additional embodiments of the assemblies. With respect to the above description, it should be considered that the optimal dimensional relationships for the various parts of the assemblies, including variations in size, materials, shape, form, function

and manner of operation, assembly and use, may be readily apparent to one of ordinary skill in the art, and all equivalent relationships to those described above and illustrated in the figures are intended to be encompassed by the present disclosure. Therefore, the foregoing is considered illustrative only, and should not be understood to limit the scope of the disclosure to the exact construction and operation discussed and illustrated.